ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

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## CLXXXV.—IPOH POISON OF THE MALAY PENINSULA.

*Antiaris toxicaria*, Lesch.

The use in the Malayan region of a vegetable poison to tip the bamboo arrows, which are discharged from a blow-pipe, is too well known to need description. To this the name *Upas* is given in Java, and *Ipo* by the Malays elsewhere. Both words have the same meaning, and, according to Blume, simply signify poison.

The properties and history of the Javanese *Upas* is the subject of almost a literature. There is no doubt that it is the produce of a tree, *Antiaris toxicaria*. The part used is the sap, which exudes when the bark is incised. It is contained in laticiferous vessels (milk-ducts) exactly in the same way as the milk of an india-rubber plant. According to Blume, the sap when drawn off undergoes rather an elaborate preparation before the blow-pipe arrows are tipped with it. But he expresses the probable opinion that the sap alone would be found equally deadly.

Its poisonous properties are, in fact, due to a definite chemical substance which has been extracted from it called *Antiarin*. Of this the following short account may be conveniently extracted from Watts' Dictionary of Chemistry:—

"Antiarin. ($C^{14}H^{20}O^5+2H^2O$.) The poisonous principle of the *Upas Antiar*, a kind of green resin which exudes from the Upas tree (*Antiaris toxicaria*), and is employed by the Javanese for poisoning

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their arrows. It is extracted by exhausting the upas with boiling alcohol, evaporating to dryness after the antiar-resin (which is innocuous) has deposited, treating the extract with water, and evaporating to a syrup; the antiarin then takes the form of scales, which are purified by re-crystallisation. It is without odour, dissolves at 22°·5 C. in 251 parts of water, 70 parts of alcohol, and 2·8 parts of ether; the solution is neutral to test papers. It likewise dissolves in dilute acids. When dried at ordinary temperatures, it contains 13·4 per cent. of water of crystallisation, which it gives off at 112° C. It melts at 220° C. into a colourless liquid, which assumes a vitreous aspect on cooling, and at a higher temperature turns brown, and exhales acid vapours. Dehydrated antiarin contains $C^{14}H^{20}O^5$ (62·69 p. c. C. and 7·45 H.). Sulphuric acid colours antiarin brown. Hydrochloric and nitric acid dissolve it without alteration; so likewise do potash and ammonia.

"Antiarin applied to a wound produces vomiting, convulsions, diarrhœa, and soon afterwards death; its poisonous action is remarkably accelerated by a mixture with a soluble substance, such as sugar. (Mulder, Ann. Ch. Pharm. xxviii. 304.)"

It has long been known that a precisely similar use of poisoned blow-pipe arrows obtains in the Malay peninsula. And the tree which furnishes the material with which the arrows are tipped has been generally regarded as identical with *Antiaris toxicaria*. Half a century ago the distinguished Indian botanist Griffith collected the plant at Malacca, and remarks on the label of a specimen in the Kew Herbarium, "the small-leaved Epoo or Jackoon poison. *But* arsenic is said to be "mixed with the milk . . . otherwise . . . said to be inert."

In 1881, Sir Cecil Smith, now Governor, but then Colonial Secretary of the Straits Settlements, communicated to Kew a bottle of Ipoh poison as well as foliage specimens of the tree from which it was obtained. These were collected by Sir Hugh Low, then British Resident in Perak, at the Plus river. The poison was kindly subjected to a very careful examination by Dr. Sidney Ringer, F.R.S., Professor of Clinical Medicine at University College, who reported that it was perfectly inert.

The plant seemed identical with that collected by Griffith, and both were identified at Kew with the Javanese *Antiaris toxicaria*. Sir Joseph Hooker in the *Flora of British India* adopted the same conclusion.

In 1889 the Straits Government sent to Kew further specimens of Ipoh poison, which were again examined by Dr. Ringer with entirely negative results.

Botanists were not, however, unprepared for this result. The Dutch botanist Blume in his fine work *Rumphia* has given an elaborate account of the Javanese Upas and of the tree which yields it (pp. 46–59, tt. 22, 23). But he points out that Rumphius, our earliest authority on Malayan botany, distinguished two kinds of Upas trees, which he termed *Arbor toxicaria femina* and *mas* respectively. The words male and female when applied to plants in the East have no special meaning, and are little more than fanciful terms of discrimination. Rumphius's *femina* was destitute of any poisonous qualities, and Blume has described it as a distinct species under the name of *Antiaris innoxia* (Rumphia, pp. 171–173, t. 54). He received specimens both from the island of Timor where Spanoghe* found that the sap was

* Spanoghe's account of the (innocuous) Upas of Timor is printed together with that of Leschenauet on the virulent kind in Hooker's *Companion to the Botanical Magazine*, vol. i., pp. 308–317.

destitute of any poisonous effect on animals; he also gives Celebes as a locality for the innocuous plant. Other botanists have not, however, found themselves able to attach much weight to the distinctive characters pointed out by Blume, and there can be no doubt that what weighed principally in his mind was the remarkable difference in the properties of the two forms. Species are, however, made by botanists on structural (morphological) differences and not on physiological. In the same species of *Cinchona* it is now known that there are the widest differences in the amount and even nature of the alkaloids which can be extracted from the bark. An equally striking, and even better known instance of difference in properties, unaccompanied by any difference in external characters, is afforded by two well-known British umbelliferous plants, *Œnanthe crocata* and *Cicuta virosa*, which Sir R. Christison found to be innocuous when grown near Edinburgh.

Kurz in his *Forest Flora of Burma* (vol. ii., p. 462), followed by Sir Joseph Hooker (*Flora of British India*, vol. v. pp. 537, 538), have combined the poisonous and innocuous forms under the older species *Antiaris toxicaria*.

Brandis in his *Forest Flora of North West and Central India* has identified with *Antiaris innoxia* the *Antiaris saccidora* of South West India. According to Beddome this is "the largest tree of the evergreen forests "of the western ghats, and the hills between them and the coast." Sacks are made of the thick woolly fibrous inner bark. The method is thus described by Graham:—"A branch is cut corresponding to the "length and diameter of the sack wanted, soaked a little, and then "beaten with clubs till the fibre separates from the wood. This done, "the sack formed of the bark is turned inside out, and pulled down, "until the wood is sawed off, with the exception of a small piece left to "form the bottom of the sack, which is carefully left untouched." It may be taken for granted that a bark which receives this amount of manipulation must be free from poisonous properties.

The identification with one and the same species of trees from widely distant localities, which have always been supposed to be distinct, is one of the uses of a large herbarium. Specimens of each can be readily brought under the eye at the same time for comparison.

Brandis remarks (*l.c.*, p. 427):—"Another species of the same genus "is found in the dense evergreen forests of the Thoungyeen Valley. In "Tenasserim (*Myah seik*, Burm.), the juice is used by the Karens to "poison arrows, but the poison does not seem equal in its effects to that "of the famous Upas tree of the Indian Archipelago." Nothing more seems known of the tree which yields the Karen arrow poison, but it is very probably referable to *Antiaris toxicaria*. And Gamble (*Manual of Indian Timbers*, p. 332) refers the Burmese name *Myah seik* to that species.

The facts as they stand present a rather curious puzzle. There can be no doubt that in Java the Upas tree furnishes a very effective arrow poison. It may be inferred that its use originated in Java and some of the other Malay islands. Finding the same tree on the mainland the Malays used its juice. But they must have long since discovered that it is innocuous. According to Griffith they remedy this defect with arsenic. If this is really done it must be when the arrows are prepared; for two authentic specimens of Ipoh poison from the Malay peninsula were absolutely inert and contained none of the poisonous principle Antiarin.

The following correspondence gives the official history of the matter and the experiments in detail.

EXTRACT from LETTER from SIR CECIL C. SMITH to ROYAL GARDENS, KEW.

DEAR SIR, Singapore, August 25, 1881.

* * * * I am sending you a small bottle containing some of the poison "Ipoh," which the Malays use on their darts and spears. There are also some of the leaves, but I am sorry to say no flowers or fruit. We have got it through Mr. Low, who managed to obtain the specimens while travelling in the country * * * *

Yours, &c.

W. T. Thiselton Dyer, Esq. (Signed) CECIL C. SMITH.

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Prof. SIDNEY RINGER to ROYAL GARDENS, KEW.

15, Cavendish Place, Cavendish Square, W.,

MY DEAR SIR, November 24, 1881.

I SEND you a report of the experiments made by Mr. Stonham and myself with Ipoh. As you will see it is quite inoperative though we administered it in large doses.

Yours, &c.

(Signed) SIDNEY RINGER.

RESULTS of Experiments with "Ipoh."

1. Nov. 5, 1881.
   Healthy frog: ½ c.c. of 5 % sol. injected under skin.
   No effect.

2. Nov. 7, 1881.
   Same frog as on Nov. 5th.
   ♏ x. of 20 % sol.
   No effect.

Between experiments 1 and 2 this frog was kept under a bell jar on a table, and this in all probability accounts for the lethargy noticed.

3. Nov. 5th, 1881.
   Healthy frog: 2.44 p.m., ½ c.c. of 5 % sol.
   2.53 p.m., ½ c.c. of 5 % sol.
   3.3 p.m., ½ c.c. of 5 % sol.
   3.10 p.m., 1 c.c. of 5 % sol.
   3.20 p.m., 1 c.c. of 5 % sol.
   3.55 p.m., ½ c.c. of 5 % sol.
   No effect.

On Nov. 7th this frog was quite well, but a little lethargic.

4. Nov. 8th, 1881.
   Healthy frog: 1 c.c. of 20 % solution.
   No effect.

5. Nov. 8th, 1881.
   Kitten, six weeks old.
   ♏ x. of 20 % solution.
   No effect.

6. Nov. 14th, 1881.
Kitten, six weeks old.
♏ xiii. of pure Ipoh.
No effect.

Summary :—In all these experiments the drug was injected hypodermically. In none were any results obtained. Certainly the frogs were a little sluggish in their movements, but this was probably owing to their being kept on a dry surface without water.

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Prof. Sydney Ringer to Royal Gardens, Kew.

15, Cavendish Place, Cavendish Square, W.,
My dear Sir, November 28, 1881.

Though the specimen you sent me is inert, no doubt *Antiarin* is a powerful heart poison, like digitalis, strophanthus, scillitin, &c., and its poisonous action is not due to arsenic, for the effects of antiarin on the heart are very different from those of arsenic.

Yours, &c.
(Signed) Sydney Ringer.

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Acting Colonial Secretary, Straits Settlements, to Royal Gardens, Kew.

Colonial Secretary's Office, Singapore,
Sir, September 17, 1889.

I am directed by the Governor of the Straits Settlements to forward the enclosed bill of lading and copy of a letter from the Resident Councillor of Malacca, regarding a box containing sap of the "Ipoh Kayu" and "Ipoh Akar," forwarded to your address by this mail, and to request that you will be good enough to examine and report upon the sap for the information of this Government.

I have, &c.
(Signed) A. M. Skinner,
Acting Colonial Secretary,
The Director, Royal Gardens, Kew. Straits Settlements.

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Resident Councillor, Malacca, to Colonial Secretary, Straits Settlements.

Resident Councillor's Office, Malacca,
Sir, September 7, 1889.

I have the honour to forward, for transmission to the Kew authorities, and for examination (a) a bottle of sap from the "Ipoh Kayu" (tree) [*Antiaris toxicaria*]; (b) a bottle of sap from the root of the "Ipoh Akar" (creeper).

2. I have procured these samples because the sap of the *Antiaris toxicaria* is spoken of in a letter from a London firm, quoted by the Director of Gardens and Forest, as a "strong poison," whereas a specimen from Perak was reported on some years ago as "innocuous," which

tallies with the information given me by the aborigines that it was not by itself poisonous, but was the vehicle for the other things mixed with it, among which is the sap of "Ipoh Akar," to form the blow-pipe arrow poison, respecting the preparation of which I communicated details when last in England to Dr. Rost, of the India Office.

I have, &c.
(Signed) D. F. A. Hervey,
Resident Councillor.

The Hon. the Colonial Secretary,
Straits Settlements, Singapore.

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Dr. Sidney Ringer, F.R.S., to Royal Gardens, Kew.

15, Cavendish Place, W.,
December 10, 1890.

Dear Mr. Thiselton Dyer,

I am very sorry so long a time has elapsed before sending you the report. The work was completed very shortly after you sent the material, but though I have often asked for the report I have not been able to get it from Mr. Bradford who made the experiments. I, however, saw them all, and so can report myself.

Mr. Gerrard, our dispenser at our hospital, a very able man, carefully examined the specimens* and could not obtain any body, either an alkaloid or glucoside, and came to the conclusion the substance must be inert. Mr. Bradford's experiments quite confirmed this conclusion.

Large doses were used without any effect; once we thought the heart after a very large dose was slightly affected, as digitalis affect the heart, but the effect was so slight and the dose so large that, practically, the substances may be pronounced inert.

Yours, &c.
(Signed) S. Ringer.

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Royal Gardens, Kew, to Colonial Secretary, Singapore.

Royal Gardens, Kew,
December 15, 1890.

Sir,

I have the honour to acknowledge the receipt of the Acting Colonial Secretary's letter of September 17, 1889 [Mal. $\frac{9590}{89}$] enclosing a copy of a letter from the Resident Councillor of Malacca, regarding specimens of Ipoh poison forwarded to me by the same mail.

2. These specimens were received at Kew. I was fortunate in inducing Dr. Sidney Ringer, F.R.S., Professor of Clinical Medicine, University College, London, to undertake their examination. He had been good enough to report previously on a sample of the same poison obtained by Sir Hugh Low, British Resident at the time in Perak, and transmitted to Kew in 1881 by the present Governor of the Straits Settlements.

3. I have, recently, reminded Professor Ringer that I had not received any report for transmission to you of the results of the examination he had so kindly undertaken. He has expressed his regret to

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* Dr. Ringer informs me that *both* specimens were examined, and both proved inert.

me at the delay, but informs me that the work was completed under his supervision shortly after the receipt of the material. Professor Ringer, however, has never succeeded in obtaining from the gentleman who made the experiments a detailed report upon them. He has now been so good as to furnish me with the results as observed by himself.

4. A chemical examination of the substance failed to show that it contained any alkaloid or glucoside, and the conclusion was, therefore, arrived at that it was inert. Physiological experiments entirely confirmed this view, as large doses were used without any effect. This entirely confirms the results obtained in 1881.

5. The inertness, which now seems to be established, of the Malayan Ipoh is certainly very remarkable if it is really derived from the Upas tree (*Antiaris toxicaria*). There can be no doubt that, at any rate in Java, the sap of that tree yields a very powerful heart poison. It is possible that the Upas of the Malay peninsula is an innocuous race, different from that of Java. I propose to discuss the whole subject in an early number of the *Kew Bulletin*.

I am, &c.

(Signed) W. T. Thiselton Dyer.

Sir J. F. Dickson, K.C.M.G.

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## CLXXXVI.—KATH, OR PALE CUTCH.

In the *Kew Bulletin* for October, 1889, an account was given of the source and manufacture of *Gambier*. This is sometimes called *Pale Catechu*.

It must not be confounded with a substance manufactured in India from an entirely different source, namely, the wood of two species of *Acacia*, *A. Catechu*, and *A. Suma*. This is called *Cutch*, or *Black Catechu*. Its composition is very similar, however, to that of Gambier.

The latter, when met with in commerce, is an earthy-looking light brown substance, consisting of cubes about an inch each side, more or less agglutinated. Cutch, on the other hand, is met with in dark brown masses, hard and brittle on the surface and at first softer within. It breaks easily when dry with a shining granular fracture.

It is, however, curious that there is a form of Cutch which a good deal approximates to Gambier. This is called *Pale Cutch;* and it is the subject of the present article.

The excellent Dictionary of the Economic Products of India which is in course of publication by Dr. George Watt, under the authority of the Government of India, gives the following account of the mode of preparation of ordinary Cutch (vol. i., pp. 29, 30):—

"At the present day, by far the most important product of *Acacia Catechu* is the resinous extract (Catechu) obtained by boiling down a decoction obtained from chips of the heartwood. The practice of preparing this extract has been handed down from remote periods. The Sanscrit authors mention the drug, and Barbosa, in his description of the East Indies published in 1514, mentions what is, in all probability, this drug under the name *Cacho*. He states that it was at that time exported from Cambay to Malacca. *Cacho* is apparently the Kanarese word *Káchu* now applied to it. It is in fact probable that the word Catechu is a modern Latin derivative from the South Indian name, and that from South India the product was first exported. Some

authors, however, say that it is derived from the Cochin Chinese word *Caycau*. One of the Tamil names for the plant is *Kati*, *Kuti*, or *Cate*, and the second half of the word may have been derived from *Chuana*, to drop or distil. Whatever may be the origin of the word Catechu, it would save much ambiguity if it could be restricted to the extract from *Acacia Catechu* instead of being made popularly to include one or two other substances such as Gambier, a word of Malayan origin signifying bitter, and applied to a purely Malayan product (*Uncaria Gambier*). It is quite true that both these astringents contain the same chemical properties, but they are obtained from widely different plants and manufactured in countries separated from each other. In our *Trade and Navigation Returns* the exportation appears as 'Cutch and Gambier,' from which one would naturally infer that both Cutch (or Catechu) and Gambier were exported from India, the relative proportions of which had not been determined. I am informed, however, by my friend Mr. J. E. O'Conor that this practice is a remnant of the time when the Straits Settlements returns were published with those of India. At present, therefore, by 'Cutch and Gambier' is meant in all probability chiefly Catechu; a small amount only of Gambier is re-exported."

The physical characters of ordinary and Pale Cutch are contrasted by Dr. Watt as follows (l. c., p. 35):—

"Commercial Catechu occurs in great masses, surrounded by leaves or broken into small blocks, in balls, cubes, or irregular-shaped pieces. In colour it is externally of a rusty brown, internally a dirty orange to dark liver colour—in some cases almost black, in others port-wine coloured. It is inodorous, with an astringent and bitter taste, followed by a sense of sweetness. It is brittle, and breaks with a fracture more or less resinous and shining. The pale form *Kath* is grey-coloured, porous, and under the microscope is seen to be composed of agglutinated masses of needle-shaped crystals.

"Kath, or Pale Catechu, is the restricted name given in Northern India to a grey crystalline substance prepared from a concentrated decoction of *Acacia Catechu* wood by placing in it a few twigs and allowing the decoction to cool. The twigs are removed, and the crystalline substance collected. Whether the liquid is rejected, or afterwards boiled down to produce a poor quality of dark Catechu or Cutch, has not been ascertained. As sold in the bazaars this crystalline substance occurs either in irregular pieces or in square blocks similar to the dark orange-brown homogeneous cubes of Catechu. This is the substance eaten by the natives in their *pán*, and which imparts with lime the red colour to the lips. It is, apparently, never exported to Europe. *Kath* and Cutch have by Europeans been mistaken for the same substance, but the former is much purer, chemically, than the latter, and it may be owing to the fact of Cutch being the form exported to Europe, that Catechu has lost the former position it held as an astringent medicine. It seems probable that the preparation of *Kath* may be a secondary process from the Cutch, since its direct preparation from the original decoction has only been observed at Kumaon, although the substance is universally used in *pán* all over India. This subject deserves to be thoroughly investigated, and the merits of *Kath* and its process of preparation made known.

"The process of preparation of *Kathá* or *Káth* is described by Madden:—

"'One portion of the Khairis is constantly employed in cutting down the best trees, and for these they have to search far in the jungles; only those with an abundance of red heartwood will answer. This is chopped into slices a few inches square. Under two large sheds are the

furnaces,—shallow, and with a slight convex clay roof pierced for twenty ordinary-sized earthen pots. This operation takes place in about an hour and a half. The liquor resembles thin light port, and the *Kathá* crystallizes on leaves and twigs thrown into it for the purpose. Each pot yields about a seer of an ashy white colour. The work is carried on for twenty out of the twenty-four hours by relays of women and children; the men merely preparing the wood, which, after being exhausted, is made use of as fuel.'"

Fluckiger and Hanbury (Pharmacographia, pp. 242, 243) give the following account of Pale Cutch as the result of their own researches :—

"In Kumaon, in the north of India, a slight modification of the process affords a drug of very different appearance. Instead of evaporating the decoction to the condition of an extract, the inspissation is stopped at a certain point and the liquor allowed to cool, 'coagulate,' and crystallize over twigs and leaves thrown into the pots for the purpose. How this drug is finished off we do not exactly know, but we are told that by this process there is obtained from each pot about 2 lb. of '*Kath*,' or Catechu, of an ashy whitish appearance."

"The Pale Cutch referred to as manufactured in the north of India is in the form of irregular fragments of a cake an inch or more thick, which has a laminated structure and appears to have been deposited in a round-bottomed vessel. It is a porous, opaque, earthy-looking substance of a pale pinkish-brown, light and easily broken. Under the microscope it is seen to be a mass of needle-shaped crystals exactly like Gambier, with which in all essential points it corresponds. We have received from India the same kind of Cutch made into little round cakes like lozenges."

The following documents give the most recent information on the subject:

INDIA OFFICE to ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.,
17th January 1891.

SIR,

I AM directed by the Secretary of State for India in Council to forward to you the enclosed copy of a Memorandum by Dr. H. Warth, of the Geological Survey of India, on the preparation of *Kath* from the wood of Acacia Catechu. Viscount Cross hopes it may be considered of sufficient interest for publication in the *Kew Bulletin*.

I am, &c.
(Signed) A. GODLEY.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.,
Director, Royal Gardens, Kew.

[Enclosure.]

MEMORANDUM on the preparation of Kath, or Pale Catechu.

In Dr. Watts' Dictionary of the Economic Products of India we find it stated that the merits and the preparation of Kath deserve to be thoroughly investigated.

As I have had occasion to study the subject and to make experiments, it may be useful to record the following facts :—

The Kath of the North-west Provinces which is used with pán and the Catechu of Burma which is exported to Europe as a dye stuff are both prepared from the wood of *Acacia Catechu*. The Kath is in its purest state chiefly catechin, a crystallizing substance, nearly insoluble in cold water. The Catechu is chiefly catechu tannin, a substance soluble in cold water and not crystallizing, but some catechin is usually mixed up

with it. The difference between Kath and Catechu is partly due to the methods of manufacture, partly to the difference in the trees.

The trees in Burma differ from those of the North-west Provinces, and at each place there are two kinds of trees, No. 1 and No. 2, although of exactly the same species. Trees No. 2 have white spots in the wood, caused by a white substance stored up in cylindrical masses half a millimetre thick and 10 millimetres long. Trees No. 1 have no white spots. Trees with spots yield an extract richer in catechin, and both kinds of trees in the North-west Provinces yield more catechin than the corresponding kinds in Burma.

I found the following proportions of catechin in the total extract:—

| | Catechin. |
|---|---|
| Burma, No. 1 | 14 per cent. |
| „ No. 2 (spotted) | 30 „ |
| North-west Provinces, No. 1 | 36 „ |
| „ „ No. 2 (spotted) | 40 „ |

The greatest amount of extract obtained from each kind of wood was as follows:—

| | Extract. |
|---|---|
| Burma, No. 1 | 17 per cent. |
| „ No. 2 (spotted) | 18 „ |
| North-west Provinces, No. 1 | 14 „ |
| „ „ No. 2 (spotted) | 24 „ |

The greatest amount of catechin obtainable from these woods is accordingly as follows:—

| | Catechin. |
|---|---|
| Burma, No. 1 | 2 per cent. |
| „ No. 2 (spotted) | 5 „ |
| North-west Provinces, No. 1 | 5 „ |
| „ „ No. 2 (spotted) | 9 „ |

Such a great proportion of catechin in the spotted wood of the North-west Provinces explains that Kath manufacture is at home there. Moreover, the local Kath makers are reported to refuse as unfit all trees which do not contain white spots, so that the trees No. 1 become wasted in the forests.

I determined the catechin by direct separation as follows. About two ounces of the wood reduced to thin shavings were boiled with 20 times their weight of water for half an hour. The extract was separated from the wood by repeated settlement, and reduced in bulk on the water bath until it just began to thicken, and contained by estimate 6 per cent. of catechin. It was then left to stand in a cool place for five days for the separation of the catechin. Once the catechin had separated, the liquid could again be diluted with cold water for the purpose of filtering. The filtered and roughly washed catechin was dried at ordinary temperature, and weighed in a thoroughly air-dry condition.

The high degree of concentration and the long standing are required because the catechin separates with difficulty out of an extract which contains so much Catechu tannin. Once the bulk of the tannin is separated, the catechin may be dissolved in much more water, and it will separate immediately on cooling, but the catechin is at all times a delicate substance, which changes with water slowly into a soluble substance, and is thus lost. The drying of the moist catechin must take

place at a low temperature, as heat at once destroys the microscopic crystals.

The manufacture of Kath, or raw catechin, is carried on in the forests with very primitive appliances. The filtering is done through layers of sand, and much sand becomes mixed up with the Kath. The drying is performed in the open air.

The people say that they possess a manufacturing secret, but there seems no need for one, unless their secret consists in the mixing of some finished catechin with the thick liquid, which sometimes promotes the separation of the new catechin. Anyhow, I made out of the 50 lbs. of *Acacia Catechu*, No. 1, from the North-west Provinces, nearly 2 lbs. of pure catechin, and it is from this wood that the Kath makers of the North-west Provinces declared themselves incapable of making Kath. For filtering larger quantities of catechin I found the filtering press an excellent expedient. The pressed catechin dried in a few days from simple exposure to the air, and once dried the catechin is a very durable substance.

Contact with iron must be scrupulously avoided during the extraction of catechin. With Catechu or Cutch contact with iron is of no consequence, and the reports mention iron caldrons in use for the final boiling down of the Cutch in Burma.

The preparation of Cutch or Catechu is of course simpler than that of Kath, because nothing but watery extraction of the wood is required, and subsequent boiling down of the extract.

After a certain degree of concentration a skin forms over the surface of the hot liquid, and constant stirring for hours is required to effect the final dessication. This long stirring process is also mentioned, but not explained, in the descriptions of the Burmese Catechu extraction. In modern dye extraction works the stirring would be avoided by the use of vacuum pans.

H. Warth.

December 1890.

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As pointed out by Fluckiger and Hanbury (Pharmacographia, p. 337), Pale Cutch and Gambier agree in composition, both consisting mainly of Catechin (Catechucic acid). This is readily soluble in hot water, but much less so in cold; it is therefore deposited in a crystalline form from its concentrated aqueous solution on cooling. This accounts for the close similarity in the mode of preparation of both Pale Cutch and Gambier. The object of all the various details of the native methods of preparation is obviously to induce crystallization when the critical point of concentration has been reached.

Ordinary Cutch contains in addition to Catechin, Catechu-tannic acid, and the presence of this substance "Catechu-tannin," according to Dr. Warth, impedes the separation of the Catechin in a crystalline form.

It is remarkable that Pale Cutch does not appear to be met with in commerce. As it so closely agrees with Gambier, which is now in great demand, it would be probably readily accepted by tanners as a substitute.

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## CLXXXVII.—PRODUCTION OF CANE-SUGAR IN THE SUGAR-CANE.

The sugar-cane will no doubt have, even when bounties are withdrawn, still to compete on no unequal terms with the beet. It is obvious, then, that no pains should be spared to increase its productiveness in

cane-sugar. Yet it is remarkable how little has been done to thoroughly investigate the life-history of the sugar-cane, and to ascertain the most favourable conditions for the formation of cane-sugar in its tissues. The only place at present in the British Empire where any scientific study of the sugar-cane has been made is at Dodd's Reformatory, Barbados, where, as pointed out in the *Kew Bulletin* (1888, p. 295), "cultural and chemical experiments with various kinds of sugar-canes" have been made, and the results published by the Government. But considering the importance of the subject it is a matter of regret that our knowledge of what may be called the internal economy of the sugar-cane is far inferior to that which has been obtained in the case of a much more intractable plant, the beet.

The great desideratum with the sugar-cane, as in the past with the beet, has been to increase its productiveness in cane-sugar. The last word on the subject is the statement of Mr. J. R. Bovell, the Superintendent of Dodd's Reformatory, in his most recent report: — "No "information has yet been obtained with regard to increasing the "richness of the canes, either by the manures or by growing them from "portions of the cane rich in sugar."

The problem of the accumulation of cane-sugar in a plant is a somewhat obscure one. The purpose of this article is to draw attention to the slender information which we have about it. Cane-sugar is one of a large number of chemical substances which play a most important part in the life of plants. They are called carbo-hydrates because they are composed of the three elements, carbon, hydrogen, and oxygen, the two latter elements being present in the same proportions as they exist in water.

Starch, from the botanical point of view, is the primitive carbo-hydrate. The whole series of substances found in the plant, which, in their ultimate constitution, are found to conform to the carbo-hydrate type, undoubtedly derive from starch by virtue of chemical changes brought about, for the most part we know not how, within the plant organism.

Starch is manufactured in the leaves of plants from carbonic acid absorbed from the atmosphere and from water supplied by the plant. The superfluous oxygen is returned to the atmosphere. Hence we get a rough justification of the term carbo-hydrate; carbon may be regarded as welded together with the constituents of water, though this is not an altogether accurate description of the process by which starch is produced. Roughly, the passage of starch, and its more intractable analogue cellulose into sugars of various composition may be regarded as a variation in the proportions with which the constituent carbon is combined with water.

Starch, as has been said, is formed in the leaves. It supplies materials from which all the solid parts of plants are built up. It must therefore, in some form or other, be capable of transport from the part of the plant where it is being formed to the part of the plant where growth is taking place. Now starch is not a very soluble substance, and we know that the materials which sustain the growth of plants can only be distributed through their structures in the soluble form. Starch, having been once formed, is practically locked up as long as it remains starch. To be available for the purposes of plant-growth it is necessary, for the most part, that it should be converted into a soluble sugar.

One of the most striking changes of this description is that which takes place in the germination of starchy seeds. The process of malting is only an arrested germination. The seeds of barley are allowed to germinate sufficiently to convert all their starch into starchy sugar, or

maltose. The reason of this is that maltose can be made to yield alcohol by fermentation, while starch cannot. Now, the conversion of starch into maltose is effected by one of a peculiar class of bodies, called ferments, whose very composition and mode of action is still imperfectly understood. In the case of starch the conversion into maltose is effected by a ferment called *diastase*.

But a ferment of the nature of diastase is, there is reason to believe, very widely distributed in plants, and is by no means confined to the seeds of barley. Diastatic ferments have been found in leaves and shoots, and it seems probable "that a ferment of this kind is present in all living plant cells." Few things have been more carefully investigated than the chemistry of malting, and it might be supposed that the chemical results of the change by which starch is converted by means of a diastatic ferment into a soluble sugar would be thoroughly understood. This is, however, far from being the case.

There can be no doubt that in the case of germinating barley the resultant is maltose. This is not, however, apparently, much met with in plants. What is met with is a substance of simpler constitution, called variously glucose, dextrose, or grape sugar. It is "widely dis- "tributed throughout the vegetable kingdom, being especially abundant "in the juice of ripe sweet fruits—the name grape sugar being derived "from its occurrence in considerable quantity in ripe grapes." If a chemist is asked as to the origin of glucose he can give no satisfactory reply.

It appears that diastase has no further effect on starch-sugar after it has produced it from starch, but that dilute acids have; and as dilute acids abound in plants we can easily understand that the starch in plants may yield starch-sugar, and that this may in turn be broken up as fast as formed. Here, however, the chemists fail us; they have not yet made up their mind as to what is the exact result of the action of dilute acids on starch-sugar.

"Although," remark Armstrong and Groves, "there can be little "doubt that the final product of the action of acids on starch is not "merely sucrodextrose [glucose], as has been very generally supposed, "it must be admitted that at present there is not sufficient evidence "as to what is exactly the nature of the product."

Still, though chemists can give no satisfactory theoretical account of the origin of glucose in the plant, it is a substance only second in importance to starch, of which there cannot be the smallest doubt, from the chemical point of view, that it is the direct derivative.

Leaving glucose for a moment, we may turn our attention to cane-sugar. While the former is a migratory product, destined to afford material for the building up of tissues, the latter, as Sachs correctly points out is a "reserve-material" stored up for some future effort of growth on a large scale, such as the process of flowering. Yet it is singular that it is twice as soluble as glucose. Nevertheless, glucose seems to be what may be called the sugar "currency" of the plant economy, and cane-sugar only the "bullion" or banking reserve. The botanist is quite clear as to what happens in a cane-sugar plant. This is Sachs' account:—"Starch is assimilated in the leaves of the Beet; "in the petioles it is found again in the form of glucose. This "glucose now enters the growing and swelling root, and is trans- "formed into cane-sugar in its parenchyma." The parallel processes in the sugar-cane seem to have been little studied. The following note is therefore reprinted from the Proceedings of the Agricultural and Horticultural Society of India for July 1890:—

## Note on Growth of Sugar-cane.

Mr. Criper presented the following suggestive note on the growth of sugar-cane :—

I am enabled, by the kind permission of Mr. Macalister of the Rosa Sugar Works, to place some analyses made by me at that place, before the Society, illustrating the gradual formation of sugar in the sugar-cane, at different periods of its growth.

The cane was analysed in July, September, and November. The three joints at the bottom of the cane, and the three at the top, just below the commencement of the leaf, were taken for analysis, the middle joints being left.

### Analyses of Canes at different Periods of their Growth, showing the Progress of Ripening.

1st Analysis.—July 31st.

Height to end of leaves - - 8 feet.
„ beginning of leaves - - 3 „
Weight of cane, whole - - 11 chittacks.
Cane only - - - - 7 „

| | Top 3 joints. | Bottom 3 joints. |
|---|---|---|
| Cane-sugar | nil. | 2·00 |
| Glucose | 1·28 | 1·60 |
| Ash | ·96 | ·73 |
| Cellulose | 6·00 | 13·95 |
| Organic matter soluble | 1·68 | ·69 |
| Acid (acetic) | ·22 | ·06 |
| Water | 89·86 | 80·97 |
| | 100 | 100 |
| Total juice | 94 per cent. | 86 per cent. |

### Analysis of Canes.

2nd Analysis.—September 12th.

Height of cane to end of leaves - 9 ft. 6 ins.
„ „ beginning of leaves - 5 ft. 4 ins.
Weight of cane only - - - 10 chittacks.
„ whole - - - 14 „

| | Top 3 joints. | Bottom 3 joints. |
|---|---|---|
| Cane-sugar | nil. | 8·00 |
| Glucose | 2·69 | 1·03 |
| Ash | ·88 | ·69 |
| Cellulose and Albuminous matter | 10·82 | 15·09 |
| Acid | ·09 | ·06 |
| Water | 85·52 | 75·13 |
| | 100 | 100 |

3rd Analysis.—November 7th.

Length of cane to end of leaves - 12 feet.
" " beginning of leaves - 8 feet.
Weight of cane, whole - - 1 seer 7 chittacks.
Cane only - - - - 1 seer.

| —— | Top 3 joints. | Bottom 3 joints. |
|---|---|---|
| Cane-sugar - - | nil. | 8·00 |
| Glucose - - - | 2·12 | ·16 |
| Ash - - - | 1·12 | ·83 |
| Cellulose - - } | 15·54 | 21·19 { Cellulose - 17·92 |
| Albuminous matter - } | | Sol. organic matter - 3·27 |
| Acid - - - | ·06 | ·07 |
| Water - - - | 81·16 | 69·75 |
| | 100 | 100 |
| Total juice - | — | 82 per cent. |

From the above analysis it will be noticed—

1st. That the top joints contain no cane-sugar in November when nearly ripe.

2nd. That glucose is invariably present, being highest in September in the top joints, and lowest in November in the bottom joints, *i.e.*, when the cane is about ripe.

3rd. The top joints contain about 10 per cent. more water than the bottom ones, and this ratio does not appear to alter during ripening.

4th. The amount of water present is from 8 to 11 per cent. more in July than in November.

Analyses of cane-juice at different periods gave the following results :—

| —— | 1st Analysis, Aug. 31st. | 2nd Analysis, Sept. 29th. | 3rd Analysis, Dec. 10th. |
|---|---|---|---|
| Height of canes to commencement of leaves. | 4½ ft. | 5½ ft. | 6½ |
| To end of do. - | 9 ft. | 10½ ft. | 10½ |
| Specific gravity of juice - | 1·037 | 1·04 | 1·071 |
| Cane-sugar - - | 4·25 | 8·00 | 16·00 |
| Glucose - - - | 1·27 | 2·00 | ·31 |
| Ash - - - | ·73 | ·78 | ·73 |
| Albuminous matter - | 1·51 | ·89 | 3·25 |
| Acidity - - - | ·16 | — | — |
| Water - - - | 92·08 | 88·33 | 79·71 |
| | 100 | 100 | 100 |

The rise in the amount of albuminous matter, and decrease in the glucose, between September and December is particularly noticed

It appears probable that the plant organism effects the conversion of the glucose into cane-sugar by combination with the elements of water.

The foregoing shows how wasteful is the practice common in some parts of India, of reserving whole canes for seed purposes instead of utilising only the upper portions of the plants, the West Indian method, as pointed out by Mr. Goodridge (*see* the Society Proceedings, September 1885), "The West Indian planter would consider it pure waste to use "his mature cane for seed [planting] . . . the tops are carefully "cut off, the stems and blades are used as fodder, and the cane tops, "about a foot long, are carefully preserved in trash, till the time for "sowing arrives." Mr. Goodridge remarked that besides saving the mature cane for the mill the use of tops for planting had other considerable advantages which he pointed out.

In connexion with the subject, the following extract from a note by Mr. J. J. Willis in the *Gardener's Chronicle* for the 12th July is of interest :—"In experiments at Rothamsted with the sugar-yielding root "crops, it was found that there was more sugar produced the larger the "amount of nitrogen applied as a manure, although not in proportion "to the amount supplied. Also that the efficiency of a given supply of "nitrogen is greatly dependent on the available minerals of the soil. "Taking the mean of many investigations in which potash formed an "ingredient in the manurial supply, it was found that 1 lb. of nitrogen "in manure yielded 20 lbs. of sugar."

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From the very remarkably research of Brown and Morris "on the germination of some of the Gramineæ," in the process of malting the conversion of starch into cane-sugar appears to be syncopated and the glucose stage to altogether disappear. It should be explained that in the seed of the barley there is a large store of starch external to the embryo. The latter grows at the expense of this store, and of course to feed it the starch has to be converted into a sugar.

The authors state :—"We cannot avoid the conclusion that trans-"formed starch is absorbed from the endosperm by the columnar epi-"thelium of the embryo in the form of *maltose*, and that this maltose, by "the more or less complicated metabolic processes of the living cells of "the embryo, is rapidly converted into *cane-sugar*."

"We have been able to demonstrate in a very striking manner the ability of the growing tissue of the embryo to convert maltose into cane-sugar. This was done by cultivating the excised embryos of barley upon a solution of maltose, and determining the cane-sugar in the plantlets after such cultivation. Although under these circumstances cane-sugar may be found within the embryo, not a trace can be discovered in the culture medium itself, which we should expect if the maltose were converted by the action of any secreted ferment."

"When, on the other hand, embryos are grown upon solutions of *dextrose* [glucose] instead of maltose, no cane-sugar is formed in their tissues."

Their researches further point to the conclusion which botanists are quite ready to accept, that cane-sugar is the diffusible carbo-hydrate which is most easily reconverted into starch and therefore cellulose. The object of the sugar-cane and of grasses generally in storing up a large quantity of cane-sugar in their tissues is to provide for the great demands of flowering and the subsequent maturation of the seed. That the sugar-cane has for the most part become sterile in cultivation does not affect the point ; the physiological habit remains, though the ultimate

purpose has been abandoned. Brown and Morris point out clearly the ultimate destination of the cane-sugar:—

"The intimate connection between cane-sugar and starch in plants has been clearly shown of late years by several chemists. In the case of the tuber of the potato, the dependence of its reserve starch upon the previous existence of cane-sugar in the juices of the plant has been very well shown by Aimé Girard (*Compt. rend.*, 108 (1889), 602). The same has been done for *maize* by H. Lepley (*Compt. rend.*, 94 (1882), 1033), and for *wheat* by Balland (*Compt. rend.*, 106 (1888), 1610)."

"In a series of experiments which we conducted a few years ago upon the barley plant, taken from the fields at various stages of its growth, we were able to satisfy ourselves that cane-sugar forms a large proportion of the sugars existing in the sap of the plant, and that this cane-sugar disappears *pari passu* with the formation and accumulation of starch in the seed."

"It is doubtless in the form of cane-sugar and its products of inversion that the transference of carbo-hydrates in the grasses mainly takes place."

One word may be added in conclusion. Cane-sugar in the sugar-cane, as in the beet, is, as will be seen, the derivative of starch. This substance is the result of the putting together under the constraining action of solar activity of the materials of carbonic acid and water. In the field of nature the process will be most effectively carried on, and the result for the same expenditure in cultivation must be largest where the supply of solar activity is most abundant. All things being equal, the formation of sugar as a product of solar activity ought, in the tropics, to be more easily and cheaply accomplished than in temperate countries.

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## CLXXXVIII.—TIMBER OF YORUBA-LAND.

The *Kew Bulletin* for October 1890 contained an account of the "Soil and Cultivation in Yoruba-land."

The following correspondence relates to the attempts made by the Governor of Lagos to draw attention to the timber resources of the same country.

A note on Iroko wood (*Chlorophora excelsa*) is appended. This was communicated to Kew by Sir Alfred Moloney, K.C.M.G., January 30, 1884, with some very attractive samples which may be seen in the Kew Museum.

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COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, November 10, 1890.

I AM directed by Lord Knutsford to transmit to you a copy of a Despatch from the Governor of Lagos, enclosing a circular on the subject of the timber of the Yoruba country, and to ask you to be so good as to advise his Lordship what steps should be taken to make the information known as desired by Sir Alfred Moloney.

I am, &c.

The Director, Royal Gardens, Kew. (Signed) JOHN BRAMSTON.

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Sir Alfred Moloney to Lord Knutsford.

Government House, Lagos,
My Lord, October 2, 1890.

The sea-board of Yoruba, represented by the Colony of Lagos, is rich in valuable woods, and the network of inland waterways exceptionally favours the development of a profitable export timber trade.

2. I have the honour to transmit a circular I have issued, having for its object the direction of commercial attention to such an enterprise.

3. I shall be obliged if your Lordship will allow such circulation thereof as will promote its object.

I am, &c.
(Signed) Alfred Moloney,
Governor.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

[*Circular.*]

Colonial Secretariat, Lagos,
September 24, 1890.

I am directed by his Excellency the Governor to draw your attention to the advisability of securing for examination and report suitable samples of the various valuable timbers of Yoruba.

There is no doubt that in the interior, and, indeed, at no great distance from the grand network of inland waterways which extends in every direction throughout this Colony, there exist a large number and variety of excellent timber trees, and that this part of West Africa, in common with the Gambia and the Gold Coast, is rich in cabinet woods of good quality and appearance.

All that is needed to make these woods an object of demand in the European market would appear to be a more complete knowledge of their commercial value, and the conditions under which they should be shipped. The celebrated trade of the Gambia in "Mahogany" (*Khaya senegalensis*) and in Rosewood (*Pterocarpus erinaceus*) is rapidly reviving, and from the Gold Coast, celebrated for its Odoom (*Chlorophora excelsa*, synonymous with Iroko, of Yoruba), an encouraging timber export has been established. Under these circumstances it would seem evident that, with proper encouragement and advertising, the timbers of Yoruba would become a profitable addition to the commerce of Lagos.

The appended list of names in the Yoruba language will serve to indicate the different varieties of timber which are at present most valued, locally, for cabinet work, house and canoe building, and otherwise.

His Excellency desires that you should further know that the Government will gladly receive specimen logs of any or all of these native trees, and will undertake to send them to England to be reported on and valued by experts. The British and African and African Steamship Companies have generously offered to co-operate with the Government in its endeavours to secure the establishment of any such enterprise in Yoruba.

The logs should be complete sections of the stems of the trees from which they are taken, should be cut from fully grown timber, and should be from four to six feet in length. The bark should be retained uninjured as far as possible.

All who are interested in the development of the commerce of the country are invited to co-operate with the Government in this matter.

Contributions can be deposited on the embankment near the Harbour Master's Office, and should in each case bear some distinctive letter or mark.

The Colonial Secretary should also be notified of the number of specimen logs supplied by each contributor, of their Yoruba names, their habitat, and distance from navigable water.

The supply of dried specimens of the leaves, flowers, and fruit will enable the Government to have the trees scientifically named.

I have &c.

(Signed) ALVAN MILLSON,
Assistant Colonial Secretary.
pro Acting Colonial Secretary.

APPENDIX.

*Names of Yoruba Timbers.*

1. Igi egba.
2. Orogbo erin.
3. Etinrin.
4. Opepe.
5. Gedu.
6. Awun.
7. Osun dudu.
8. Palufon.
9. Iroko.
10. Ayon.
11. Abora.
12. Ofun.
13. Osere.
14. Orosun.
15. Abadu.
16. Koriko.
17. Eki.
18. Osun.
19. Iroko oni koko.
20. „ tuntun.
21. Olugbomdu.
22. Akomu.

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ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, November 13, 1890.

I HAVE the honour to acknowledge the receipt of your letter of November 10, transmitting a copy of a Despatch from the Governor of Lagos with copies of a circular on the subject of the timber of the Yoruba country.

2. I have despatched copies to the persons to whom I think it is likely to be commercially interesting, and I propose to reprint it in the forthcoming number of the *Kew Bulletin*.

I am, &c.

(Signed) W. T. THISELTON DYER.

John Bramston, Esq., C.B.

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NOTE on Iroko wood by Sir Alfred Moloney, K.C.M.G.

The *Iroko* of the Yoruba country, West Africa, is known on the Gold Coast, behind the Accra coast line, as *Odüm*. To the countries mentioned it is invaluable, as it can withstand for years, not only the weather (for it is often used in exposed parts of buildings, &c.), but also the attacks of the white ant. It is used largely for building purposes, being cut and sawn into beams and plank. Window-frames, shutters, doors, furniture, exterior balconies or verandahs, fences, shingles, &c., are made from it. Most of the Basel Mission Houses on the Gold Coast are, as to woodwork, made of it. I was informed a shingle roof of this material lasted some 20 years.

The *Iroko* or *Odüm* has been and is regarded as a Fetish tree.

Iroko wood is also suitable for furniture, as it is very ornamental when polished, exhibiting a combination of the character of satin and wavy maple woods.

Its botanical identity was determined at Kew. It proves to be the product of *Chlorophora excelsa*, Benth. and Hook. f., and is a near ally of Fustic (*Chlorophora tinctoria*), the well-known dye-wood of the W. India islands and Brazil.

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## CLXXXIX.—PHYLLOXERA.

The ravages of the Phylloxera upon the vine have been the subject of numerous notices in the preceding volumes of the *Kew Bulletin:* vol. iii., p. 66, Phylloxera in Asia Minor; p. 230, Phylloxera in South Africa; p. 236, Erroneous Report of Phylloxera in Greece; p. 255, Regulations at the Cape; vol. iv., p. 36, Phylloxera in Victoria.

The present position of the struggle between the vine and this ineradicable pest is conveniently summed by Mr. C. V. Riley in the following extract from his annual address to the second annual meeting of the Association of Economic Entomologists, published in *Insect Life*, the periodical Bulletin of the Division of Entomology of the United States Department of Agriculture for January 1891. Mr. C. V. Riley is the Entomologist of the Department, and, it is scarcely necessary to add, the leading authority in Economic Entomology at the present day.

"The Grape Phylloxera has continued to attract the attention, not only of most European Governments, but also of those of Australia and New Zealand. It continues its spread in France, having at last invaded the more valuable champagne districts. The last report of the Superior Phylloxera Commission of that country shows that about 240,000 acres have undergone defensive measures, submersion being employed in 72,000, bisulphide of carbon in 145,000, and sulphocarbonate of potassium in 23,000. The work is practically at an end in such Departments as Hérault, Gard, and Gironde, where the American resistant vines have most effectually been used; while the wine-growers of Algeria, Spain, Italy, Portugal, Hungary, Austria, and Switzerland are all battling against it, and are all more or less aided by their respective governments.

The advent of the insect in New Zealand has been the cause of much writing and of much legislation there, and the government has been quite anxious to get the best and latest information on the subject. There is very little that is available in the way of published experience in this country, as my Missouri reports are now very difficult to obtain. I would repeat here in substance what I have recently written to Sir F. D. Bell, Agent-general at London for New Zealand, because the demand for the information is continuous, and our own people are, to a great extent, unfamiliar with the facts.

During the more than twenty years' struggle in France against the species innumerable remedies have been proposed, most of which have proved to be absolutely valueless. A few measures have been devised, however, which, under proper conditions, give fairly satisfactory results. These consist in (1) methods which avoid the necessity of direct treatment, comprising the use of American stocks and planting in sandy soils; (2) the employment of insecticides (bisulphide of carbon, sulphocarbonate of potassium, and the kerosene emulsion); and (3) submersion.

It was early found in the history of this Phylloxera that most of the cultivated varieties of American grape-vines, as also the wild species, resisted, or were little subject to, the attacks of the root form (*radicicola*) of the Phylloxera, although the leaf gall form (*gallicola*), which in point of fact does little if any permanent damage, occurs in greater numbers on many of our wild and cultivated sorts than on the European grape-vines, which are all derived from the single species, *Vitis vinifera*, and which are so exceedingly subject to the attacks of the root form. This fact was first noticed in France by M. Laliman, of Bordeaux, and later by Gaston Bazille, of Montpellier, and was independently proved on a more extended scale by my earlier investigations in the United States. The use of American stocks upon which to cultivate the susceptible European varieties has resulted in an enormous trade in certain American seeds and cuttings, and now supersedes all other methods against the insect.

It was my privilege and pleasure to spend a week in August 1889 among the world-renowned Médoc and Sauterne vineyards of the Bordeaux district in France. Here, by virtue of the rich alluvial soil and the ease with which the chief vineyards can be submerged, the Phylloxera has made slower headway, and the opposition to the use of American resistant stocks has been greatest. Yet they have finally vanquished prejudice and are, either from necessity or choice, rapidly coming into general use. When I say choice, I mean that even where the French vines yet do well and the Phylloxera is kept in subjection by other means, it is found that great vigour of growth and increase in healthfulness and yield of fruit result at once from the use of American stocks.

Without going into a lengthy discussion of the subject of wild American species, those of practical importance to the grape-grower are the following: *Vitis æstivalis*, *V. riparia*, and *V. labrusca*.

The varieties derived from *V. æstivalis* are of value for their fruit as well as for their resistant qualities, and, being easily propagated from cuttings, they are very often used in France as stocks. The most important varieties are Jacquez, Herbemont, Black July, and Cunningham.

The varieties of *Vitis riparia*, both wild and cultivated, are, on account of their special fitness, almost exclusively employed in France as resistant stocks, for which they easily take first rank. The varieties used are, first, the wild forms; and, second, the cultivated varieties Solonis, Clinton, and Taylor. Of the cultivated varieties, the Clinton was one of the first vines tried for this purpose and has been extensively used with fair satisfaction. The Solonis now ranks above it, but is valueless for any other purpose on account of the acidity of its grapes. In California, the Lenoir, Herbemont, and Elvira have been used, but late experience shows that the wild Riparia is most satisfactory there, as it is in France.

The different varieties of *Vitis labrusca* are less resistant to the Phylloxera than those above mentioned. Certain varieties have, however, been grown successfully in France, and of these the Concord has given much the best results; but others, Isabella and Catawba for example, succumb there to the root-louse, as indeed they do in many sections of this country.

Of the many valuable hybrids obtained from the American species of *Vitis* which are serviceable as stocks, the more important are the Elvira, Noah, and Viala. The last named, perhaps of all the resistant varieties, gives the greatest per-centage of successful grafts, and is admirably adapted for grafting on cuttings.

Early in the study of the subject it was found that the nature of the soil has a very marked influence on the success of the different stocks. The subject has now been quite fully investigated in France, and the latest researches are formulated by the experimental school at Montpellier in the statement quoted below, which will be of interest as giving the various classes of soils, together with the American vines best adapted to each.

(1.) New, deep, fertile soils: *Riparia* (tomentous and glabrous), *Jacquez*, *Solonis*, *Viala*, *Taylor*, and *Cunningham*.

(2.) Deep soils, somewhat strong, not wet: *Jacquez*, *Riparia*, *Solonis*, *Cunningham*, *Viala*, *Taylor*.

(3.) Deep soils of medium consistency, new and not dry in summer: *Riparia*, *Jacquez*, *Solonis*, *Viala*, *Taylor*, *Black July*.

(4.) Light pebbly soils, deep, well drained, and not too dry in summer: *Jacquez*, *Riparia* (wild), *Taylor*, *Rupestris*.

(5.) Calcareous soils, with subsoil shallow or granitic: *Solonis*, *Rupestris*.

(6.) Argillaceous soils, white or grey: *Cunningham*.

(7.) Argillaceous soils, deep and very wet: *V. cinerea*.

(8.) Deep, sandy, fertile soils: *Riparia* (wild), *Solonis*, *Jacquez*, *Cunningham*, *Black July*, *Rupestris*.

(9.) Light pebbly soils, dry and barren: *Rupestris*, *York*, *Madeira*, *Riparia* (wild).

(10.) Deep soils, with a tufa base and salt lands: *Solonis*.

(11.) Soils formed of débris of tufa, but sufficiently deep: *Taylor*.

(12.) Ferruginous soils, containing red pebbles of silica, deep and somewhat strong, well drained, but fresh in summer. All the varieties indicated, and in addition: *Herbemont*, *Clinton*, *Cynthiana*, *Marion*, *Concord*, *Herman*."

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## CXC.—BOTANICAL STATION AT LAGOS.

Particulars respecting the establishment and progress of this the first Botanical Station on the West Coast of Africa have already been given in the *Kew Bulletin* (June 1888, p. 149; March 1889, p. 69; and July 1890, p. 162).

The following correspondence gives the most recent accounts of its progress.

The prospects of Annatto cultivation at this station are discussed in the *Kew Bulletin* for July 1890.

At the conclusion of last year the late Curator, Mr. James McNair, resigned his appointment for the purpose of returning to the West Indies. He has been succeeded by Mr. Henry Millen, of the Royal Gardens, Kew.

The Colony is under great obligations to Mr. McNair for the faithful way in which he has carried out the work entrusted to him of organising and stocking the new station, which has now, it is hoped, passed into the stage of a permanently useful institution.

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COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, January 30, 1891.

I AM directed by the Secretary of State for the Colonies to transmit to you, for your information, the accompanying paper relating to the Botanic station at Lagos.

I am, &c.

(Signed) ROBERT G. W. HERBERT.

The Director, Royal Gardens,
Kew.

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Sir A. MOLONEY to LORD KNUTSFORD.

Government House, Lagos,

MY LORD, December 31, 1890.

IN continuation of my Despatch, No. 386, of the 27th ultimo, I have the honour to transmit the twelfth report on the Botanic Station of the Colony of Lagos, for the quarter ended the 30th of September 1890.

2. 3130 plants and 32 ounces of Annatto seed have been sold in addition to the yield of the vegetable garden. The plants consisted chiefly of 1,480 coffee, 800 annatto, 49 cacao, and 300 coco-nut seedlings.

3. The amount realised by the sale of the products of this department was 12*l.* 8*s.* 11*d.*

4. Many contributions were made to the station during the quarter, acknowledgments of which are detailed in the report.

5. The rainfall has considerably exceeded without harm that for the corresponding periods of 1887, 1888, and 1889.

6. The graceful and useful beef-wood tree, *Casuarina muricata*, seeds of which were kindly supplied in March quarter 1889 by the Royal Gardens, Kew, has been found to answer here admirably; it thrives luxuriantly even along the sand beaches in close proximity to the sea.

7. A small nursery of fibre-yielding plants of commercial importance has been established in the Western District.

8. There has continued the usual activity in the direction of the extension of the cocoa-nut industry in the form of adding seeds to the local nurseries and of planting out seedlings in permanent places.

9. I regret that some damage by fire, which is to be attributed to accident, has occurred to the Government cocoa-nut plantations in the Western District, the effect of which cannot yet be accurately gauged. The copious rain that has since fallen it is expected will revive many.

I am, &c.

(Signed) ALFRED MOLONEY,

The Right Hon. Lord Knutsford, G.C.M.G., Governor.
&c. &c. &c.

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## CXCI.—MEALY BUG AT ALEXANDRIA.

In the *Kew Bulletin* for May 1890 an account is given of "a Mealy Bug, very destructive to cultivated plants," which has recently made its appearance at Alexandria. This was described by Mr. J. W. Douglas as *Crossotosoma ægyptiacum*.

Mr. Riley, the United States entomologist, makes the following remarks upon the subject in the January number of *Insect Life*, p. 184:—

"A study of Mr. Douglas's description and figures has convinced me that this insect is an *Icerya*, and that its spread is greatly to be feared judging from our experience with *I. Purchasi*. Moreover, three additional species of this genus have been brought to my notice during the year: one occurring in Mexico on grapevines; another in Key West, Florida, upon roses and other garden plants; and the third in the island of Montserrat, West Indies, upon the cocoa palm, the banana, and a species of *Chrysophyllum*."

A full account of *Icerya Purchasi*, Maskell, the Fluted Scale-insect, was published in the *Kew Bulletin* for August 1889.